ROYAL ASTRONOMICAL SOCIETY.

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Rev. R. SHEEPSHANKS, Vice-President, in the Chair.

Lieut. Alexander Ross Clarke, R.E., was balloted for, and duly elected a Fellow of the Society.

The editor of the *Nautical Almanac* has had the kindness to forward several copies of the *Supplement* for 1853, containing *Ephemerides* of the newly-discovered planets for the present year. These are for distribution among the Fellows who wish to observe the faint planets.

Among the presents received by the Society, there is one which demands particular notice, viz. a new Astronomical Journal, published monthly at Cambridge, U.S., of which four numbers have already appeared. The editor, Dr. Benjamin Apthorp Gould, Jun. states in a short preamble, that this is "a pure scientific journal devoted exclusively to astronomy and its kindred departments of inquiry," and expresses an opinion that astronomy has already reached a stage of developement in America which justifies the hope that such a publication will be adequately supported. The principal memoirs which have appeared, or are in the course of publication, are,—*Development of the Perturbative Function of Planetary Motion*, by Professor Pierce; *Zodiac of Hygeia*, by Professor Hubbard; *On the Orbit of the Great Comet of* 1843, by Professor Hubbard; *On the Velocity of the Electrical Wave through a Metallic Circuit*, by Professor O. M. Mitchell; *Observations of Metis*, by Mr. James Ferguson, at Washington, and by M. C. Rümker; *On the Phenomena attending the Disappearance of the Rings of Saturn*, by Mr. G. P. Bond; *On the Heliocentric Place of Neptune*, by Professor Coaklay; *Note on the Parallelogram of Forces*, by Professor Pierce. Each number is a handsomely printed sheet in 4to. All communications are to be addressed to the editor, B. A. Gould, Jun., Cambridge, Mass. A volume will consist of twenty-four numbers, with a table of contents and alphabetical index. The price of subscription, five dollars, payable in advance. Mr. John Chapman is the London agent.

VESTA.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1850.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″	Comp^{d}.—Obs^{d}. R.A. s	N.P.D. ″	Stars of Comp.
Jan. 26	10 14 19·8	7 9 14·56	65 23 40·2	+2·26	+16·8	μ, β Geminor.
Feb. 12	10 26 9·3	6 56 35·36	64 28 17·7	1·84	13·1	δ, β Geminor.
13	8 43 58·5	56 8·57	26 2·1	2·00	13·0	— —
16	7 34 7·6	54 55·76	19 24·3	1·68	12·4	— —
20	8 14 4·3	53 44·22	64 11 26·0	1·87	10·8	— —
28	11 3 24·7	53 0·39	63 59 12·9	1·66	9·7	— —
Mar. 10	10 44 4·6	55 2·77	50 32·2	1·60	9·0	— —
11	7 40 52·3	6 55 22·13	63 50 4·1	+1·77	+10·3	— —

"The observations are corrected for refraction and parallax. The computed places of the planet and the places of the stars of comparison were taken from the *Nautical Almanac*."

JUNO.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1850.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″	Comp^{d}.—Obs^{d}. R.A. s	N.P.D. ″	Stars of Comp. B. A. C.
Feb. 28	14 25 47·1	13 43 56·90	93 51 6·0	+2·31	+19·3	4571, 4665
Mar. 3	12 2 21·3	43 5·05	93 32 10·6	2·20	18·7	4571
9	11 58 22·3	40 44·06	92 50 12·9	2·47	19·6	4571, 4665
10	11 53 58·4	40 16·28	42 52·5	2·58	20·2	— —
11	11 14 39·6	39 48·10	35 38·5	2·64	22·1	— —
12	11 28 11·1	13 39 17·79	92 28 3·5	+2·66	+18·4	— —

"The observations are corrected for refraction and parallax. The computed places of the planet were taken from the *Nautical Almanac*, and the places of the stars from the catalogue cited."

METIS.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1850.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″	Comp^{d}.—Obs^{d}. R.A. s	N.P.D. ″	Stars of Comp. B. A. C.
Feb. 20	7 16 28·9	0 30 47·20	89 58 3·1	−0·75	−4·3	95, 204
Mar. 4	7 18 11·6	0 52 47·48	87 19 14·5	0·56	1·8	324
12	7 39 45·7	1 7 49·61	85 33 42·1	−0·53	−2·5	437

"The observations are corrected for refraction and parallax. The computed places of the planet were deduced from Mr. Graham's ephemeris, published in the *Astronomische Nachrichten*, No. 700. The places of the stars of comparison are taken from the catalogue cited."

ASTRÆA.

LIVERPOOL. Equatoreal. (Mr. Hartnup.)

1850.	Greenwich M.T. h m s	R.A. h m s	N.P.D. ° ′ ″
Feb. 13	7 12 38·4	3 14 28·96	77 19 64·6
	7 32 36·1	29·91	58·5
	7 52 34·5	30·84	51·7
	8 12 32·4	3 14 31·80	77 19 46·5

"The planet was compared with 5 *Tauri*; each determination is from a transit over five wires and the readings of two microscopes. The place of the star is from the Greenwich catalogue."

HEBE.

HAMBURG. (M. C. Rümker.)

1850.	Hamburg M.T.	R.A.	Dec.
Feb. 22	$11^h 41^m 57^s·6$	$201° 55' 5''·9$	$+6° 32' 40''·0$

"Apparent place of star of comparison was,

R.A. $13^h 25^m 36^s·82$ Dec. $+6° 37' 22''·9$

"This star was observed by Bessel once, and is 25050, 25054 of the Lalande catalogue. The R.A. of 25034 is erroneous 6^s in the catalogue."

Observations made during a Transit of the Fourth Satellite of Jupiter and its Shadow over the Disk of the Planet. By Mr. Lassell.

1850, Feb. 28. "After an intensely cloudy day, the sky suddenly cleared at about 10^h mean time; but on directing the large equatoreal to *Jupiter*, I found the air very disturbed, and unfit for either large power or aperture. I therefore went into the smaller dome, and pointed the 9-foot equatoreal to *Jupiter*, power 222.

"$11^h 48^m$, G.M.T. The 1st satellite is eclipsed; the 2d is receding eastward; the shadow of the 4th is on the face, and the satellite approaching the disk. (For brevity's sake I will designate the satellites simply by their appropriate numerals.)

"There is a striking difference in the brightness of 2 and 4: 4 is of a dull pale colour compared with 2, presenting a much greater contrast than can be supposed to arise from its greater proximity to *Jupiter*. The air is very unfavourable, the planet dancing and shuddering so that I cannot endure power 291. I do not think, after minute attention, that the *disk* of 2 is quite so large as that of 4, though, at first, the superior brightness of 2 vividly suggests the notion that it is so; 4 appears *round*, as well as 2, but 3 (*much* larger than 2) is oblong or irregular.

"$12^h 11^m$. The shadow and satellite being now equally distant

from the limb, the greater size of the shadow is most obvious; indeed it appears to be twice as great in diameter.

"$13^h\ 10^m$. The first satellite has now emerged, and is about three-fourths of its diameter distant from the limb.

"With 20-foot equatoreal, power 297, I measured the distance of the centre of the shadow of 4 from *Jupiter's* southern limb = 33″·88. Distance of shadow from northern limb = 8″·72.

h	m	s	
13	24	0.	The fourth satellite is entered upon the face, about one-third of its diameter.
13	28	0.	The disk of the satellite is, I think, bisected by the limb of the planet.
13	30	49.	I can just see a piece of the satellite projecting, perhaps a bare third of its diameter. The state of the air is, however, very unfavourable.
13	34	0.	I have now lost sight of the satellite.
13	42	42.	I begin to see again the satellite as a dusky spot on the face of *Jupiter*, near where the satellite entered.
13	46	7.	It is very plain. The spot is very small, not half the diameter of the shadow. A well-defined belt is near the northern limb of *Jupiter*.
13	49	0.	The satellite is entered on a course across the planet, which will apparently bring it twice as near to the northern limb as the shadow has been.
13	51	0.	The satellite is fully two of its diameters within the limb. The second satellite is obviously brighter and larger than the first. Air increasingly disturbed.
14	6	0.	The shadow is just touching the southern part of the belt; and the satellite, though fairly within it, is near its northern edge.
14	23	0.	The shadow and satellite are now equally near the preceding and following limbs.
14	35	0.	The satellite is now advanced four-tenths across the disk, and the shadow approaching the preceding limb.

"Measured the distance of the satellite from northern limb: mean of three measures = 5″·50.

"In the absence of the shadow I should certainly call the satellite a *black spot;* but when compared with the shadow, its blackness is certainly much less intense. I should estimate the satellite now to be rather more than half the diameter of the shadow; the best estimate I can form is that one is double the *area* of the other. The satellite does not appear to me otherwise than *round*, so far as the agitated sky will allow me to judge. Although the satellite entered upon a belt in transiting the planet, it was never visible as a *bright* spot, though the other satellites appear almost universally as bright spots when only just entered within the limb. When the

satellite was about half across the disk, the sky became so increasingly tremulous that I found it useless to continue observing.

"1850, March 5. The early part of the evening was quite cloudy, but about 10^h *Jupiter* appeared, shining through haze.

"At $10^h\ 30^m$, G.M.T., the shadow and satellite are both visible, rather more than half across the disk, the shadow as a perfectly round black spot. The satellite is a small, irregular, *dusky spot*, about two diameters of the shadow north-following. Twenty-foot equatoreal employed, power 297. The satellite elongated N. and S., and not half the diameter of the shadow. The circumstances were bad, *Jupiter* never being clear during the entire transit. I made six measures, with the Munich parallel wire-micrometer, of the diameter of the shadow, the mean of which is $1''{\cdot}537$.

"At $11^h\ 50^m\ 57^s{\cdot}5$ the shadow was bisected by the planet's limb.

"At $12^h\ 6^m\ 41^s{\cdot}5$ the satellite was bisected by the limb. The shadow and satellite passed over a pretty bright part of *Jupiter's* disk, a little north of the principal northern belt; yet, when the preceding limb of the shadow was nearly touching the limb of *Jupiter*, I lost sight of the satellite, and shortly afterwards recognised it as a *bright spot*, when still clearly within the planet's disk. When the preceding limbs of the satellite and planet were coincident, the satellite appeared very well defined as a bright spot, of far greater magnitude than it had when seen as a dusky spot.

"At $12^h\ 15^m$ the sky completely clouded.

Remarks.

"The phenomenon of the dusky spot, in the case of the third satellite, being changed into a bright one when near *Jupiter's* limb, seems to indicate a far greater difference of brightness between the central and circumferential parts of *Jupiter* than the unaided sense of vision would indicate; also that the fourth satellite, not exhibiting such a change even when less contrasted by transiting along a belt, must reflect very little light or have a great part of its surface covered by shades. Its roundness seems to indicate that such shades or markings must be distributed pretty evenly over its surface, and yet on this hypothesis it is difficult to explain its smallness in comparison with the shadow. Can it be that, as suggested by the comparative dulness of *Jupiter's* circumference, the central parts alone of the satellite reflect sufficient light to affect our vision?

"The sky on the 28th of February was so disturbed that I did not think that any measures of the diameter of the shadow of 4 could be got with reasonable accuracy; but, as far as I could estimate its size, I should deem it somewhat larger than the shadow of the third satellite, measured on the 5th of March. Taking it, however, at the same size, and supposing the measure of $1''{\cdot}50$ to be correct, I make the resulting diameter of the shadow to be 3027 miles, and the diameter of the satellite (deduced from the size and distance of the sun) to be 5197 miles. I do not know whether this magnitude

is at all reconcileable with its mass (if ascertained), under any probable hypothesis of density; but it has occurred to me that careful measures of the shadows of the satellites of *Jupiter* would afford the most likely means of getting at their real magnitudes, and I propose to take every opportunity of making such observations."

Additional Observations of the Phenomena of Jupiter and his Satellites, with the Twenty-foot Equatoreal. By Mr. Lassell.

"1850, March 10, M.T. $10^h\ 40^m$. Air less disturbed than usual. Power 316. The view of the planet uncommonly fine, with occasional intervals of atmospheric agitation. The central bright part of *Jupiter* is mottled or curdled, and indeed scarcely any part of his surface is of uniform texture.

"The southern portion is covered nearly up to the edge of the principal belt with a decided shade. With power 430 the third satellite is certainly not round, but the atmosphere is not fine enough for scrutinising satellites with this power. The fourth and third satellites are very near each other, and pretty well removed from *Jupiter*. The fourth is much paler than the third. The first satellite is obviously larger than the second — scarcely, I think, so bright.

"March 12, G.M.T. $11^h\ 25^m$, power 430. The air is unusually fine. I think I never saw so fine, so powerful a view of *Jupiter*. The third satellite is approaching the following limb of the planet, whose light, diminishing the brightness and radiation of the satellite, enables me to see it with admirable distinctness. There is certainly a *spot* on the satellite's disk, in the north preceding quadrant. Its disk also seems a little flattened on the following side.

G.M.T. h	m	s	
12	6	34.	The limbs of the 3d satellite and *Jupiter* are in contact.
12	8	30.	The satellite appears now the most beautiful round disk, and I am certain of seeing the spot upon it.
12	11	48.	The satellite bisected by *Jupiter's* limb.
12	16	6.	The following limbs of the planet and satellite in contact.
12	18	30.	The satellite is now a large *bright* round spot on the face of *Jupiter*, just within the limb.
12	21	30.	The satellite is getting fainter. I see nothing yet of the shadow. The satellite enters between two rather faint belts.
12	24	30.	I only see the satellite by glimpses. I have not yet caught sight of the shadow.
12	29	6.	I caught the first glimpse of the shadow.

G.M.T. h m s	
12 33 46.	I obtained a glimpse of the satellite as a *light brown spot*, and about ten seconds later I should estimate the bisection of the shadow to take place; but, my attention being directed to the reappearance of the satellite, I could not precisely note the time.
12 35 30.	The satellite is a plain *dusky* spot.
12 39 35.	The satellite is now a *dark, irregular* spot.
13 5 35.	The satellite is now obviously *darker* than the darkest part of either of the principal belts, is about half the diameter of the shadow, and, though more nearly round, is still of an irregular figure.
13 12 25.	The broad belt which now covers the southern pole of *Jupiter* is adorned with a number of bright, distinct, round spots, just like so many satellites on the face, only smaller. There are at least six, and I was enabled to mark roughly the places of five of them. This is to me quite a new phenomenon. The spots are very delicate, but very round and well defined, and, though only occasionally seen, when the air is most quiet, they undoubtedly exist, and there is no illusion. The shadow of the satellite seems to have a penumbra.
13 43 0.	The air is now becoming more disturbed.
13 46 0.	The satellite is now half-way over, still a little oblong. Its intensity of *shade* I should estimate to be half-way between the blackness of the shadow and the darkest parts of the belts; in *size* about two-thirds the diameter of the shadow.

"During a considerable portion of these observations the air has been remarkably fine — indeed a whole year does not yield five such nights; yet, with the power and aperture employed, the image of *Jupiter* was never *still*. The presence of the atmosphere never could be forgotten; and I received this evening a strong confirmation of the opinion I have long held, that a twenty-four-inch aperture, brought to high perfection of defining power, is not far from the maximum allowed by the atmosphere of this climate to be advantageously used on objects requiring fine *definition*."

Extract of a Letter from Mr Lassell.

"The times of emersion of shadow and satellite on March 5 were respectively about 7^m and 5^m earlier than the times in the *Nautical Almanac*, and the entry of the 4th satellite on the disc, Feb. 28, was about 8^m later than the time announced.

"I took five measures of the polar diameter of *Jupiter*, Feb. 28, with my own-made micrometer = 42″·81, circumstances very bad. On March 5 I took eight measures of the equatoreal diameter with the Munich micrometer = 44″·64, circumstances rather better, but bad."

Mr. Lassell proposes to resume these observations when the weather is favourable.

"My equatoreal-clock does admirably. All those I know go very differently, with and without a drop of oil, and I do not know that I need say less of my own."

Mr. Hartnup says, "I saw the fourth satellite on the face of *Jupiter*, on Feb. 28. It appeared to me only a few shades lighter than the shadow. I looked at the planet, unprepared for the phenomenon, and my first impression was, that I saw the shadows of two satellites. The shadow was very large, and the diameter of it and of the satellite would have admitted of measurement had the atmosphere been favourable. The definition was very bad."

Proper Motions of 875 *Stars of the Greenwich Catalogue of* 1439 *Stars, deduced by Comparison with the Places derived from Bradley's Observations, as given in the Fundamenta Astronomiæ for the Epoch* 1755. By the Rev. R. Main, M.A., of the Royal Observatory.

"One of the great objects of modern astronomy is to enable us to predict accurately the place of a given fixed star for a given epoch, and this problem the resources derived from the masses of accurate observations that are now systematically made and reduced at the great observatories of Europe enable us to solve for a tolerably large number of stars. If, in star observations at the different observatories, anything like an organised plan of division of labour had been adopted and carried out for a period of some years, we should have at the present time means of determining accurately the places of at least all the stars contained in the three great fundamental catalogues of Bradley, Piazzi, and Groombridge, and consequently every facility for determining the proper motions of all the stars contained in those catalogues. In the instance of the last-mentioned catalogue, viz. that of Groombridge, we shall soon, through the well-directed labours of Mr. Johnson, be thus situated. He has, with an energy deserving the highest praise, very nearly completed the reobservation of all Groombridge's stars, and the formation of the catalogue containing the resulting places will form a new epoch in the sidereal astronomy of the northern heavens. But in general no systematic reobservation of the other great catalogues has been attempted, and the proper motions of stars must be deduced from the results that are found scattered in the obser-

vations, or the catalogues resulting from the observations, of the different modern observatories.

"Since the epoch of Piazzi's catalogue the most important general catalogues have emanated from Greenwich:—

"I mean, first, Pond's Greenwich catalogue of 1112 stars whose epoch is 1830.

"Secondly, Airy's Greenwich catalogue of 1439 stars whose epoch is 1840; which contains the results of all the Greenwich observations of stars from 1836 to 1841 inclusive.

"Thirdly, Airy's Greenwich catalogue of 2156 stars, which includes the results of the former catalogue (the second named), and gives additionally for the epoch 1845 the results of all the observations of stars from 1842 to 1847 inclusive.

"During the greater part of the time during which I have been engaged on the present work the last-named catalogue was not published, but I have been enabled to make use of the places given in it for completing all such results as in the second catalogue were given in only one element. The proper motions are, therefore, generally completely given in both elements, except in a few cases where there are no corresponding observations in the *Fundamenta*, or where the catalogue of 2156 stars does not contain a corresponding observation to that of Bradley.

"A glance at the Introduction of the volumes of the *Greenwich Observations* will enable us to see that the importance of the stars thus compared is much greater than their numbers would seem to warrant; for, in the first place, all the fundamental stars contained in the list of the *Nautical Almanac* have been observed with such frequency and accuracy as to render the calculation of their places an object of very great importance. In the next place, nearly all the conspicuous stars that fall in the path of the moon during a whole revolution of the node have been observed with sufficient frequency to give accurate places, so that the places given in the Greenwich catalogue, combined with the proper motions deduced by comparison with Bradley, will enable us to predict their places for nearly a century to come with amply sufficient accuracy for all the purposes of lunar astronomy. Lastly, a great many stars within the zodiacal limits have been observed for general purposes, and many that pass very near to the zenith of Greenwich, and are therefore useful for redetermination of the constants of refraction, and for geodetical purposes. In fact, few of the stars in the Greenwich catalogue have been observed without some special object that renders the determination of their places valuable. I have been induced, by the above reasons, to select the catalogue of 1439 stars for comparison with Bradley; and I hope to be able to add, from time to time, the results of the comparison of all those remaining in the catalogue of 2156 stars, and of others which may be given in future Greenwich catalogues."

Mr. Main then enters into the intricate subject of precession, and briefly explains the methods adopted by Bessel, Otto Struve, and Peters, in determining the values of the constants m and n for

every ten years between 1750 and 1850. The annual precession for each star is,

$$\text{In R.A.} = m + n \,.\, \sin\alpha \,.\, \tan\delta : \text{In Dec.} = n \,.\, \cos\alpha.$$

"The table from which the precessions used in this paper have been computed is as follows:—

Year.	Annual General Precession.	m.	n.	Log. n.
	″	″	″	
1750	50·2298	46·0481	20·0650	1·302439
1760	·2320	·0509	·0642	·302421
1770	·2343	·0538	·0633	·302402
1780	·2366	·0566	·0624	·302383
1790	·2388	·0595	·0616	·302365
1800	·2411	·0623	·0607	·302346
1810	·2434	·0651	·0598	·302327
1820	·2456	·0680	·0590	·302309
1830	·2479	·0708	·0581	·302290
1840	·2502	·0737	·0572	·302271
1850	50·2524	46·0765	20·0564	1·302253

In computing the whole precessional motion, Mr. Main has adopted the formula pointed out by M. Otto Struve, viz.:—

"If p_1, p_2, p_3, be the annual precessions in R.A. or N.P.D. for a star, not very near the pole, at equidistant epochs t_1, t_2, t_3, and if the whole interval from t_1 to t_3 be T,

$$\text{Then the whole precessional motion} = \tfrac{1}{6}(p_1 + 4\,p_2 + p_3) \times \mathrm{T},$$

$$\text{or the mean annual precession} = \tfrac{1}{6}(p_1 + 4\,p_2 + p_3),$$

which is generally sufficient. If four or five equidistant precessions be similarly computed,

$$\text{Mean precession} = \tfrac{1}{8}(p_1 + 3\,p_2 + 3\,p_3 + p_4), \text{ or}$$

$$= \tfrac{1}{90}(7\,p_1 + 32\,p_2 + 12\,p_3 + 32\,p_4 + 7\,p_5)$$

respectively."

Mr. Main then shows how, by taking advantage of the nearness of his epochs to equidistance, he has been enabled to avail himself of Bessel's precessions for 1755 and 1800, after applying certain corrections which he has tabulated under a very convenient form:—

"For a few stars near the pole the whole precessional motion was computed rigorously by Bessel's method, given in the *Fundamenta* and the *Tabulæ Regiomontanæ*, by means of the numbers given by Mr. Baily in the Introduction to the *Catalogue of the British Association*. Suitable corrections were applied to reduce the resulting mean annual precession to that which would have been obtained by using Peters' constants."

The results of Mr. Main's investigations are arranged in three catalogues.

First, a list of 875 stars, with the proper nomenclature and the

numbers of the *Fundamenta* affixed, of which the proper motion has been determined by a comparison between the *Fundamenta* and the *Greenwich Catalogue of* 1439 *Stars*, using Peters' precession. There are four columns to each element, which are respectively the correction to Bessel's precession, the mean precessional motion according to O. Struve's and Peters' determination, the mean annual motion as deduced from a comparison of the two catalogues, and, lastly, the proper motion or difference between the two preceding columns.

Secondly, a catalogue of stars selected from the previous catalogue, which have proper motions greater than $0^{s}\cdot005$ in R.A. or $0''\cdot1$ in N.P.D. To this catalogue, which contains nearly 370 stars, the approximate R.A. and N.P.D. of the stars are added, as well as Argelander's magnitudes and the number of observations.

Thirdly, a catalogue of those stars in the first list which have proper motions exceeding $0^{s}\cdot02$ in R.A. and at least $0''\cdot3$ in N.P.D. These are 85 in number, including double stars: and Mr. Main has appended two new columns, containing the factors of the effect of solar motion upon each star in R.A. and N.P.D., supposing the motion to be $= 1$, and directed to a point in the heavens which is in R.A. 260° and N.P.D. $55^{\circ}\ 37'$. Mr. Main considers this motion, first pointed out by Sir W. Herschel and since established by the investigations of Argelander, O. Struve, and Galloway, to be quite certain, and that the direction is pretty well fixed. The quantity of the solar motion, as detected by O. Struve, is less certain, but yet a fair approximation, which may perhaps be improved by taking the results of the present memoir into consideration.

The errors introduced into the catalogue of the *Fundamenta* by Lindenau's value of the constant of nutation, now generally considered erroneous, cannot be *completely* eliminated, except by reducing the observations anew, or by a careful rectification of Bessel's MSS. computations.

"With regard to double stars I have been guided by their closeness and the probable nature of Bradley's observations. If one star of a tolerably close double star is considerably brighter than the other, I have compared Bradley's observation with the Greenwich observation of the larger star. If the stars be close and tolerably equal in magnitude, I have compared Bradley's observations with the mean of the Greenwich observations for both stars, if both have been observed. I have, in every case, given due attention to the nature of the observations.

"I hope the results of this comparison of the Greenwich catalogue with that of Bradley, by means of the best known modern data, will be acceptable to astronomers, at least as a basis for future operations. Before we can hope to improve greatly our present sidereal knowledge, it will be necessary that this labour be undertaken for all the stars of the catalogues of Bradley and Piazzi; and, for this purpose especially, that pains be taken in our principal observatories that such stars in those catalogues as have

not been recently observed should be so as speedily as possible, and with sufficient frequency to give places of indisputable accuracy.

"In the mean time the recently published Greenwich twelve years' catalogue will still further assist our inquiries; and I hope, at no distant time, to be able to offer to the Society the result of the comparison of all the stars common to it and the *Fundamenta* which are not already included in the present memoir."

Extract of a Letter from Mr. J. Curley, of Georgetown College, Washington.

"On the 28th November last, the Rev. T. M. Jenkins, a member of this College (to whose liberality we are indebted for our observatory), when on his passage to Rio Janeiro, saw a comet, of which the following is a description.

"On the 28th of November, at $7^h\frac{1}{4}$ p.m." (being then in about 10° S. latitude, and 30° W. longitude), "we saw a comet to the westward, nearly in the track of the sun, about 14° above the horizon, as measured with the quadrant. The nucleus very distinct, about as large in appearance as *Mars*, the tail curved and pointing towards the south (SW.), quite bright and nearly a degree in length as seen by the naked eye, but much larger when viewed with the glass. It was seen by all the crew for about twenty minutes, when a cloud obscured it and it was seen no more."

Mr. Curley suggests the probable identity of this comet with the great comet of 1556, to which Mr. Hind has drawn attention. Mr. Hind remarks on Mr. Curley's letter,—"I think it is *quite possible* that the comet seen by the Rev. T. Jenkins on November 28, 1849, may have been the great one expected about that time. My own opinion, however, though I must admit the possibility of the identity, is, that the object observed was not the expected comet. If we are to understand by 'the track of the sun,' the *same parallel of declination*, the right ascension of the comet would have been about $18^h\,30^m$, giving the time of perihelion passage, with my elements, about Nov. 13, 1849, but on this supposition the comet's declination would be rather less than that of the sun, which seems to be contradicted by the direction of the tail. Again, if we suppose the two comets identical, and perihelion passage November 13, it is not very easy to account for its not having been observed after the 28th of that month, since it would be receding from the sun's place, though at the same time going away from us.

"I do not think it is practicable to observe the comet now, if it were in perihelion between November 10 and 20, 1849. I find, if we fix the perihelion passage on November 10, the comet's position, April 1, will be about,

Right Ascension, $2^h\,21^m{\cdot}3$. North Polar Distance, 92° 39′.

Distance from earth, 3·40

,, sun, 2·56

"And if we suppose perihelion passage November 20, we have for April 1,—

Right Ascension, $2^h\ 14^m{\cdot}9$. North Polar Distance, $92°\ 26'$.
Distance from earth, 3·27
,, sun, 2·42

"The comet must, therefore, be situate in strong twilight; but, perhaps Mr. Lassell, Mr. Hartnup, or Professor Challis, may think it worth while to look at the neighbourhood. I am prevented here by trees."

On the Expected Comet of 1264 and 1556. By Mr. Hind.*

"Mr. Barber, who was recently elected a Fellow of the Royal Astronomical Society, and who undertook to continue the calculation of the perturbations of the comet of 1556, which I had commenced in 1848, has just sent me a notification of one of his results, which appears to show that the comet may not be due for some time to come; at any rate, it renders a close and systematic research very desirable. Mr. Barber finds that the effect of the attraction of *Jupiter*, *Saturn*, and *Uranus*, from 1556 to 1592, and of *Jupiter* alone to 1806 (including the aphelion portion of the orbit), will *retard* the comet no less than 750 days; and there can, I think, be very little doubt that *Saturn* and *Uranus* will delay it still longer.

"Mr. Barber is computing the disturbances produced by *Saturn* up to 1806, but has not yet completed them. The 750 days added to the time of arrival at perihelion, supposing T unaltered, brings us up to April; but even this must be too early, if the major-axis in 1556 corresponded to the periodic time from 1264 to 1556; and I think there is as much reason to suppose it longer as shorter than the value thus found.

"My object in writing to you is to apprise you of Mr. Barber's results, in case you think there are other observers, with telescopes of sufficient power, who would be willing to look out for the comet. I find it is most convenient to project the calculated places on a chart: it is then easy to see in what *line* the comet should be sought, on any particular date, according to different hypotheses respecting the time of arrival at perihelion.

"I think what is most wanted is an ephemeris for distances of (say) 140 or 150 days from perihelion passage, for at this time of the year the part of the heavens where the comet is to be sought will be near opposition.

* As the *Notice* is going to press, Mr. Hind informs me that he has reason to believe the return of this comet may be delayed by perturbation *for some years*. I have therefore suppressed the *sweeping* ephemerides which he had computed on the supposition that the perihelion passage of the planet might be expected next autumn. A further account of this comet may be expected from Mr. Hind very shortly.—*Ed. M. N.*

"In a day or two I will send you positions for April, on the supposition that the comet will arrive at perihelion in August, September, and October. I had, for the sake of convenience, laid down the places on a chart, which is much the best plan for practical purposes, but any one may do this when they are furnished with the computed positions.

"My ephemeris I will send as soon as possible. Mr. Barber has worked very hard on this comet, and has been compelled to use various artifices to shorten the work, some of which I believe to be new. Thus, at the aphelion, he has proceeded by equal intervals of *true* anomaly, and one or two changes have been made in the usual application of the formulæ of integration. I will ask him to send you an account of his work, as it is right the trouble he has taken should be appreciated.

"By far the largest perturbations occur at great distances from the sun. I knew this had happened in the case of Halley's comet, which was my reason for supposing that the comet of 1556 would furnish another instance, since the *cause* must be more powerful in the latter case."

Note from M. O. Struve to G. B. Airy, Esq. Astronomer Royal, and President of the Royal Astronomical Society.

"To my note on the parallax of Groombridge, 1830, I must make an addition. I have found a third system of equations, in which the conditions of the systems I. and II. have been combined as well as possible. The resolution of the new equations has given the following results:—

The parallax	$= +0''.034$ with the probable error	$0''.029$
The proper motion in declination	$-5''.748$ ——	$0''.024$

These values must be regarded as the definitive result of my research.

"1850, *Jan.* 3."

Extract of a Letter from Mr. Lowe on Zodiacal Light, as seen at Highfield House, near Nottingham.

"As some curious features have been noticed in the '*Western Light*,' whether it be the zodiacal light or another phenomenon, a brief extract from my journal has been thought to be acceptable.

Epoch 1850, February $13^d\ 7^h\ 30^m$.

"The zodiacal light was certainly more brilliant to-night than it has been for the last seven years (*i. e.* as far as my observations extend); it exceeded the brightness of the milky way about the *Swan*, which was the part compared with it. *Saturn* was about 2° within its southern edge, and its apex must have had an altitude equal to that of the *Pleiades*. Unfortunately clouds came over before any bearings were made. *Saturn* was thought to be dimmed by it.

Epoch 1850, March $6^d\ 7^h\ 42^m$.

"Extent of base on horizon, 36°; its southern edge cut the horizon 13° S. of W., and its northern edge 23° N. of W.; long. of apex ♉ 21° 30′ when at its brightest, yet at times only visible to ♉ 17°; axis slightly N. of *Pleiades*, and the horizon 5° N. of W. The S. edge somewhat confused, but appeared to pass through ξ *Ceti*, α *Ceti* about 2° within the edge; the N. edge was better defined, and was tolerably bold about γ *Arietis*; it passed through ε *Piscium*, between γ and β *Arietis* (about midway), and 1° S. of δ *Arietis*. Not nearly so brilliant as on February 13^d, but appears to have pulsations of greater and less brilliancy in periods of 30^s. This was first noticed by several small stars being alternately visible and invisible; it was not changeable like aurora borealis, for it invariably receded to a certain dimness, and then brightened to a certain extent.

Epoch 1850, March $7^d\ 8^h\ 0^m$.

"The N. edge certainly extended to β *Arietis*. Pulsations of greater and less brilliancy again noticeable.

Epoch 1850, March $8^d\ 7^h\ 15^m$.

"Pale and confused. Stars dim.

Epoch 1850, March $9^d\ 7^h\ 55^m$.

"Brilliant for a few minutes, during which time the alternating of brightness was observed.

Epoch 1850, March $10^d\ 7^h\ 50^m$.

"Brilliant for 7^m; then clouds. Its N. edge was thought to extend to α *Arietis*. Strong pulsations; brighter than last night.

Epoch 1850, March $11^d\ 7^h\ 59^m$.

"Fainter. The apex reached ξ *Arietis*. The S. edge passed just to the north of μ *Ceti*, ξ *Ceti* about 2° within the edge; the N. edge half-way between α and β *Arietis*. Faint pulsations.

Epoch 1850, March $12^d\ 8^h$.

"Fainter. S. edge confused; N. edge passed between α and β *Arietis*, but slightly nearer β than half-way. Apex reached ξ *Arietis*.

Epoch 1850, March $13^d\ 8^h$.

"Yet fainter. N. edge passed between α and β *Arietis*, yet still nearer β than last night. Apex reached ξ *Arietis*.

"Clouds or moonlight prevented the phenomenon being noticed between February 13^d and March 6^d, and from March 13^d to 23^d (present time). I had seen it, and noted down bright zodiacal light, from the middle of January; and it appears to have been increasing in brilliancy up to the time we lost sight of it first, viz. February 13^d. During its second appearance it has been gradually fading. The stars α, β, and γ *Arietis* were well situated for marking

its northern edge at that point. From the position of these stars with respect to the luminosity, it appears that it was moving northerly amongst the stars from the 6d to 10d, and southerly from the 10d to 13d."

Lieut. J. M. Gillis, U.S.N., has forwarded several copies of his memoir "*On the Longitude of Washington, computed from the Moon-culminations observed during the years* 1839–1842, *inclusive*," extracted from the "*Transactions of the American Philosophical Society.*"

The observations on which the present result is founded were all noted by the same person with a 5-foot transit by Troughton, solidly mounted. They have been computed by the direction of Professor A. D. Bache, director of the American coast-survey. The formula of reduction, which is given, is due to Mr. S. C. Walker. The observations, which were made at the *old naval observatory*, have already been extensively circulated.

The corresponding observations of Copenhagen, Kremsmünster, Cracow, and Wilna were computed, but the results showed errors of such magnitude in the adopted longitudes that they have not been incorporated. Assuming the longitude to be $5^h\ 8^m\ 4^s{\cdot}6$ W., we have the following corrections from the observations of the moon and stars at the respective observatories.

	1st Limb.	No. of Obs.	2d Limb.	No. of Obs.
	s		s	
Washington and Edinburgh	−7·51	64	−1·57	23
Oxford	7·81	32	2·77	13
Greenwich	3·75	60	3·38	41
Cambridge	1·58	57	6·96	23
Hamburg	−5·05	69	−4·87	12

Combining these results according to their weights,

	s
282 observations of the 1st limb give a correction of	−4·81
112 ,, 2d ,,	−4·06
Or the quantity to be subtracted from the assumed long. =	−4·60

Hence the *old naval observatory* is $5^h\ 8^m\ 0^s{\cdot}0$ W., or 77° 0′ 0″.*

* We are told that the old naval observatory was 1200 feet N. 5° W. from the centre of the Capitol-dome, in approximate latitude 38° 53′ 33″ N. Its longitude had been previously found to be $5^h\ 8^m\ 4^s{\cdot}6$ W. by the solar eclipse of 1836, by 8 corresponding immersions, and by 13 corresponding emersions of star occultations. It is singular that there is, so far as we can see, no reference to the *new or present national observatory* in this memoir. This oversight should be remedied without delay, for the very accurate determination contained in this memoir is chiefly valuable, as connecting the *national* observatory at Washington, now in full activity, with other observatories, the position of which, with respect to Greenwich, is either well known or in the course of becoming so.

ERRATUM.

In the last Annual Report, p. 94, *for* 373397·7 years, *read* 37339·7 years.

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